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CURRENT AND FUTURE SUNFLOWER PRODUCTION IN THE UNITED STATES: IMPLICATIONS FOR RESEARCH AND EXTENSION

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FRED E. WESTBROOK

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Joint Planning and Evaluation

Staff Paper

United States Department of Agriculture
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Preface

This paper was prepared to call to the attention of SEA Management and other decision-makers the unusual growth in the production and marketing of sunflower in the United States in the decade of the 1970's. Major breakthroughs that have accelerated the production and profitability of the crop have been noted. One of these breakthroughs was the development of high oilseed varieties of sunflower by Soviet scientists. The other major breakthrough was the development of high producing hybrid varieties by United States scientists.

More importantly, the paper attempts to show the potential of the sunflower as an alternative cash crop for areas on the pheriphery of the Corn Belt where it can compete with soybeans. It also shows that sunflower has promise in the double-cropping systems especially in the South.

The paper explores the feasibility of increasing research and extension resources in the expanded areas of production to solve production and marketing problems that are inherent when programs are expanded into new geographic areas. The results of this increased research and extension activity may be increased productivity for the producer, and possibly increased domestic and export trade for the sunflower and its products.

The author is indebted to Gary Evans, Jesse Goble, James Hall, Robert Leffel, Roland Robinson, and Eldon Weeks for providing helpful suggestions in revising this paper. Special thanks are given to John M. Brazzel for his comments on the organization of this paper.

CURRENT AND FUTURE SUNFLOWER PRODUCTION IN THE UNITED STATES: IMPLICATIONS FOR RESEARCH AND EXTENSION

EXECUTIVE SUMMARY

This paper gives a brief survey of the status of the sunflower in the United States and in the world. The sunflower industry in the United States enjoyed phenomenal growth in the decade of the 1970's. While most of this growth occurred in the tri-State area of North Dakota, South Dakota, and Minnesota, other States on the pheriphery of the Corn Belt and in the South have the potential for and have begun producing sunflower as an alternate cash crop.

As sunflower production expands into these new areas with different soil types and climatic conditions, new problems associated with this production cause some crop losses. Yield losses due to sunflower pests (insects, diseases, weeds, birds) are major impediments to further expansion of the production areas. The search for new and improved varieties, better cultural practices, and better chemical controls for pests are among the top research and extension needs for making sunflower an alternative cash crop in a larger area of the United States.

The paper surveys the sunflower production in the United States; major breakthroughs in production; properties of the products and by-products; foreign and domestic markets and the research and extension needs to maintain continued growth and development of the industry in the 1980's.

The specific purposes of this paper are to: 1) examine the status of the sunflower and its rapid rise in production, in the United States, 2) note the contribution that the sunflower can make and is making in the United States

export and domestic markets, and 3) determine if recommendations should be made to increase the level of efforts in SEA research and extension to assist producers in coping with problems of insect, disease, and management inherent in expansion programs.

The harvested acreage of sunflower in the United States increased from 209 thousand in 1970 to 5.4 million in 1979. This phenomenal growth has been due largely to two major breakthroughs. The first one was the development of high oil sunflower varieties by Soviet scientists with an oil content of about 40 percent. The second breakthrough was the development of hybrid sunflower varieties by United States scientists which boosted yields by 25 percent.

More than 90 percent of the sunflower production comes from the four States of North Dakota, South Dakota, Minnesota, and Texas. Other States on the periphery of the Corn Belt and in the South are expanding their sunflower production acreage as varieties are improved and profits increased.

Sunflower seedlings are more tolerant of frost than many crops making the sunflower an attractive row crop for areas of the Great Plains where frost may occur during the seedling stage. There is an increasing interest in sunflower production in the Upper Midwest as an alternative cash crop and a viable rotation crop for small grain. In the South, sunflower plantings have caught on rapidly as a result of cutbacks in cotton allotments and attempts are being made on a relatively large scale to integrate the sunflower into double-cropping systems in this region.

Two types of sunflower are grown: 1) those for oilseed production and 2) those for the confectionery market. The oilseed varieties generally are black-seeded and have a thin hull that adheres to the kernel. Seeds of the oilseed varieties contain from 38 to 50 percent oil and about 20 percent

protein. Nonoil sunflower is also referred to as confectionery and striped or large-seeded varieties. Seeds of the nonoil varieties generally are larger than those of the oilseed types and have a lower oil content and test weight.

The major product of the oilseed sunflower is sunflower oil. This oil is higher in polyunsaturates than corn oil and is much more stable than safflower oil. Thus it has an edge over these two competitors for use in premium grade margarine, cooking and salad oils. The major product of the confectionery type sunflower is the whole seed grown for human consumption or for birds or seed eating animals. For human consumption the seeds are marketed either in the hull or dehulled similar to the peanut.

By-products of the processed sunflower have attracted considerable attention. Sunflower meal contains about 28 percent protein and 26 percent fiber. This makes an excellent feed for ruminant animals. Sunflower seed hulls are used as a roughage in certain animal feeds. The hulls can also be burned to produce heat, or used to make fiberboard.

The possibility of using sunflower oil as a diesel fuel substitute for on-farm use is being explored and shows some promise. Because of the wide range of climatic adaptation and the high yield of oil per acre the sunflower looks more promising than most crops as a vegetable oil substitute for diesel fuel.

More than 75 percent of the sunflower crop is exported. This places sunflower among the top 10 agricultural export products. Western Europe is by far the largest market for U.S. sunflower taking nearly 90 percent of all U.S. sunflower exports.

The domestic market for sunflower also shows promise of considerable growth with one new processing plant scheduled to open in 1980 and another by 1982 in the North Dakota-Minnesota area. Other processing plants are being planned exclusively for processing sunflower oilseed outside of the traditional

sunflower producing area.

In view of the favorable export market for sunflower seed, and because of its potential as a viable alternative cash crop for many producers on the periphery of the Corn Belt, the Red River Valley of the Dakotas and Minnesota, and the southern Cotton Belt States, and because of its growing popularity in the domestic market it is recommended that additional research efforts be devoted to: 1) The basic biology of major sunflower insects in the search for controls; 2) the development of sunflower germplasm with improved disease and insect resistance; 3) increasing the percentage of oil in the sunflower seed; 4) determining more efficient and more economical ways of using sunflower oil as a substitute for diesel fuel. It is further recommended that additional research and extension initiatives be directed to the improvement of cultural practices in general, especially in the expanded production areas, through demonstration plots. And that research and extension efforts be devoted to marketing alternatives programs for producers.

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CURRENT AND FUTURE SUNFLOWER PRODUCTION IN THE UNITED STATES: IMPLICATIONS FOR RESEARCH AND EXTENSION

Fred E. Westbrook [1/]

INTRODUCTION

This paper gives a brief survey of the sunflower industry in the United States and its rapid rise to prominence in the decade of the 1970's. Major breakthroughs in the industry, important geographic areas of production, product properties, export and domestic markets, potentials for additional expansion in production areas, and research and extension implications are important areas covered.

The sunflower has emerged from the obscurity of backyard gardens to become one of America's newest major agricultural cash crops. Even though it has been a major oilseed crop in other parts of the world for many years, the sunflower plant is a native of North America. The sunflower has been identified as one of the oldest native crop species in North America and grows wild in many areas of the United States. It was grown by the Native Americans for food in North Carolina before 1600 and by the New England colonist for hair oil as early as 1615 (4).

The sunflower was introduced into Spain from Central America before the middle of the 16th century. During the next 300 years it spread across Europe and into Russia. By the mid-1800's, the sunflower was extensively grown as an oilseed crop in Russia and by 1900 it was a major agricultural crop. During the late 1800's, the sunflower was reintroduced into the United States and Canada by a few seed companies and by immigrants. The large-seeded confection type

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1/ The author is Program Coordinator, Program Planning Staff (formerly on the Program Analysis Staff) Joint Planning and Evaluation, Science and Education Administration, U.S. Department of Agriculture.

sunflower was locally grown in Canada and the United States, and by 1950 was being grown commercially in both countries.

The sunflower has been grown commercially in the United States on a limited scale for a number of years, principally for sale to the whole-seed market. Prior to 1966 production was largely confined to the large seed or medium large seed varieties suitable for the bird seed, nut, and confectionery markets. Since 1966, oilseed sunflower production has become a crop of economic importance in the United States (3). Production has been concentrated in the Red River Valley area of North Dakota and Minnesota. In 1967, 93,000 acres of oil varieties of sunflower were harvested in these two States.

The prospect for the sunflower becoming an important commercial crop in the United States has generated interest not only in the Red River Valley area of the North Central States, but also in the southern Cotton Belt States. In 1968, commercial scale trial plantings were made in the Cotton Belt States under sponsorship of the National Cotton Seed Products Association. Some 40,000 acres were planted that year (4). Some of the reasons for the stimulated interest for growing sunflowers in these areas are: 1) the need for a profitable alternative cash crop; 2) growing world demand for edible oils; 3) excess crushing capacity among screw press cotton seed oil mills; 4) the rising importance of sunflower oil in world markets; 5) growing emphasis on health benefits of polyunsaturated vegetable oils in the diet; 6) the introduction of high yielding hybrid sunflower varieties; and 7) the use of sunflower in a double cropping system.

Expanded world sunflower production has resulted primarily from the development of high oilseed varieties by Soviet scientists and more recently from the development of high producing hybrid varieties by United States scientists. The

sunflower is widely grown in the world where climates are not particularly favorable for soybean and corn production. Second only to soybeans it is the second most important source of vegetable oil in the world.

As sunflower production expands into new areas with different soil types and climatic conditions, additional management problems must be addressed. Effective pest control and cultural practices are especially critical to success in these expansion areas. The search for improved varieties and the utilization of effective cultural practices are likely areas for increased research and extension efforts.

The purposes of this paper are to: 1) examine the status of the sunflower and its rapid rise in production in the United States, 2) note the contribution that the sunflower is making and can make in the United States export and domestic markets, and 3) determine if recommendations should be made to increase the level of efforts in SEA research and extension to assist the producers in coping with problems of insect, disease and management and cultural practices inherent in expansion programs.

World Production Status

Worldwide the sunflower production area covers approximately 20 million acres with the largest acreage grown in the Soviet Union. The 1979 U.S. production area of over 5.4 million acres places the United States second only to Russia as the leading world producer of oilseed sunflowers. Argentina which ranked second in the world production until 1979 now ranks third behind the U.S.S.R. and the U.S. At the start of the 1980's, USDA analysts are predicting that the U.S. will become the world's largest producer of sunflower in the next

few years. The U.S.S.R. has that honor for the moment, but the Soviets are still cultivating open-pollinated sunflower varieties and their production has stagnated in recent years at around 12 million acres. If the technological leaps in sunflower yield and oil content that researchers now foresee are realized, the U.S. will undoubtedly move into the forefront in world sunflower production (7).

The U.S. is already the world's largest exporter of sunflower seed. U.S. farmers export over 75 percent of the sunflower seed they produce. By contrast, in the U.S.S.R. sunflower is the main source of vegetable oil, and most of the Soviet production is consumed domestically.

The world production of oilseed sunflower in June of 1980 was estimated at 15.38 million metric tons (8). Of this total production it is estimated that the Soviet Union will produce 5.37 million metric tons; the United States 3.49 million metric tons; Eastern Europe 2.27 million metric tons; and Argentina 1.60 million metric tons, Table 1.

Production in the United States

Before 1966, sunflower acreage in the United States was devoted primarily to nonoil varieties. Rapid progress made in sunflower varietal improvement, recent expansion of production, and wide interest shown by farmers suggest that the sunflower is becoming, or has become a major crop in the United States. The crop has been grown on the northern and western fringes of the Corn Belt where corn and soybeans have not performed well because of the short growing seasons or periodic droughts (3).

Table 1. Sunflower Production: World and Selected Countries, regions, and commodities.

Commodity	Major regions and countries					
	United States	Eastern Europe	USSR	Latin America and Caribbean / Argentina	Total for major regions and countries	World
Sunflower Seed	-- million metric tons --					
1977/78	1.33 1/	1.93	5.90	1.60	11.60	12.89
1978/79	1.84 1/	1.96	5.33	1.43	11.58	12.81
1979/80						
May est.	3.49 1/	2.27	5.37	1.70	14.14	15.50
June est.	3.49 1/	2.27	5.37	1.60	14.05	15.38

1/ Assumes reported production for four States representing 94 percent of U.S. total in 1977/78 and 95 percent in 1978/79 and 1979/80.

(Data taken from Reference 8)

Commercial production of the nonoil sunflower, also referred to as confectionery or large-seeded sunflowers has occurred on a limited basis in the United States for several decades. California was the major producer of nonoil sunflower before the late 1950's. Since then most commercial production has been in the Red River Valley of North Dakota and Minnesota. The increase in nonoil sunflower production has been relatively stable and has averaged 13 percent per year during the 1968-1977 period.

Nonoil or confectionery types of sunflower are used for human consumption and bird feed. About 50 percent of the nonoil seed production is used for confectionery, primarily in two forms. The largest seeds are separated, roasted, packaged whole, and sold in the same way as roasted peanuts in the shell. A majority of the remainder of the confectionery is dehulled and the kernels used in confectionery products. A fraction of smaller seed from the nonoil seed crop is used mainly in rations for pet birds, seed-eating animal pets, and outdoor wild bird feeding stations.

The first sustained commercial production of oil sunflower in the United States began in 1966 when about 6,000 acres of high oil Soviet varieties were grown. Production of the oilseed type sunflower has increased more rapidly than nonoil sunflower because of the strong export demand.

Since 1970 there has been a tremendous expansion of sunflower acreages harvested in the United States. In 1970, 207,600 acres were harvested in the United States as compared to 5.4 million acres harvested in 1979 (Table 2). From 1977 to 1979, the sunflower acreage harvested more than doubled from 2.2 million acres in 1977 to 5.4 million in 1979 (Figure 1). The total yield in 1970 was 186 million pounds as compared to 7.3 billion pounds in 1979 (Figure 2). This increase in production cannot be attributed exclusively to increased acreage. The yield per acre has increased from an average of 902 pounds per

Table 2. SUNFLOWER PRODUCTION IN THE U.S.

	Acres Harvested (1000 Acres)	Total Yield (1000 Lbs)	Average Yield/Acre (Pounds)
1970	207	186,670	902
1971	392	411,680	1,050
1972	692	633,560	916
1973	666	719,070	1,080
1974	548	524,705	957
1975	709	786,010	1,109
1976	810	857,100	1,058
1977	2,205	2,760,470	1,252
1978	2,798	3,852,540	1,362
1979	5,410	7,305,590	1,350

Date taken from Reference 11.

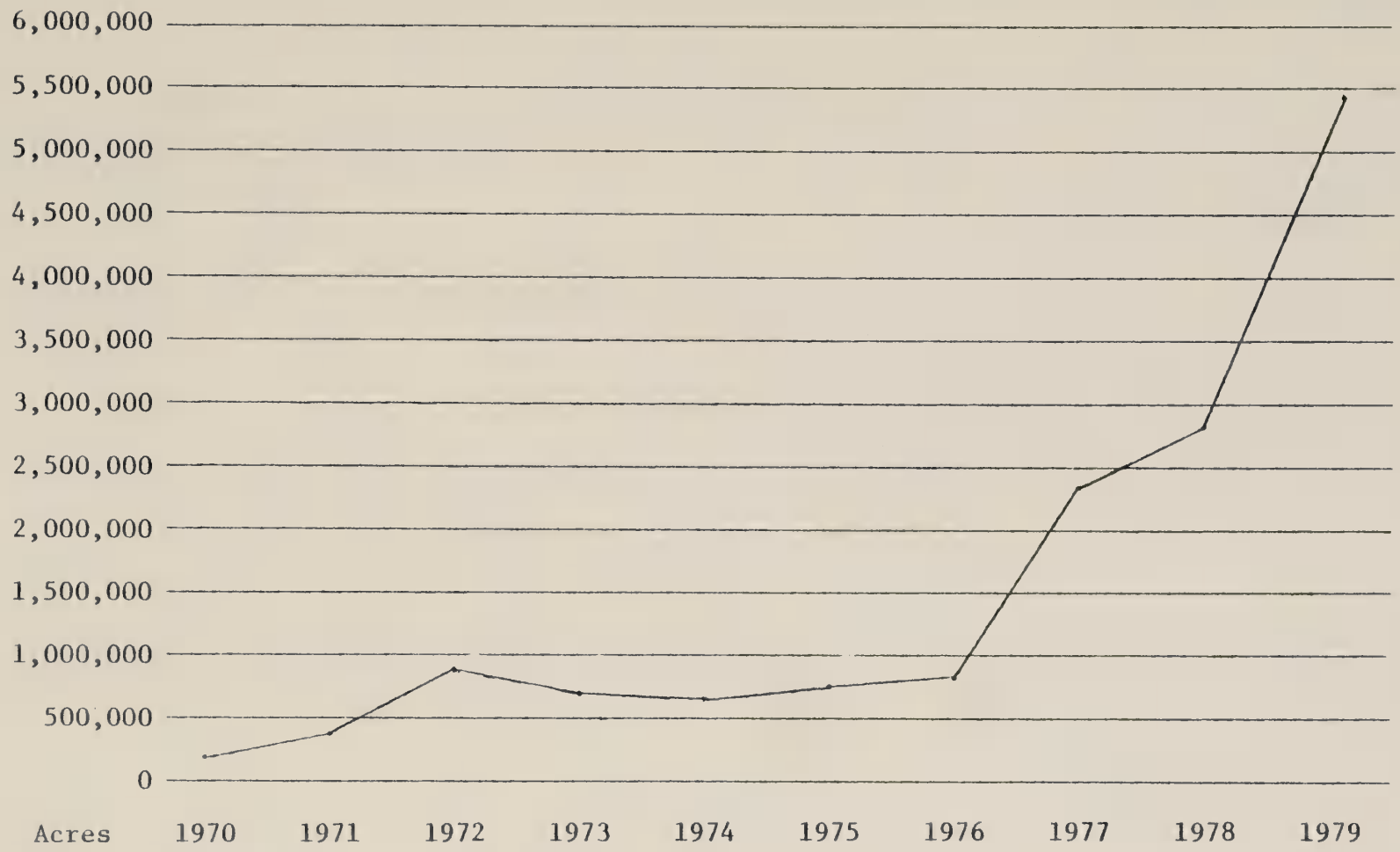


Figure 1. Sunflower Acres Harvested from 1970 to 1979
(Data taken from Reference 11.)

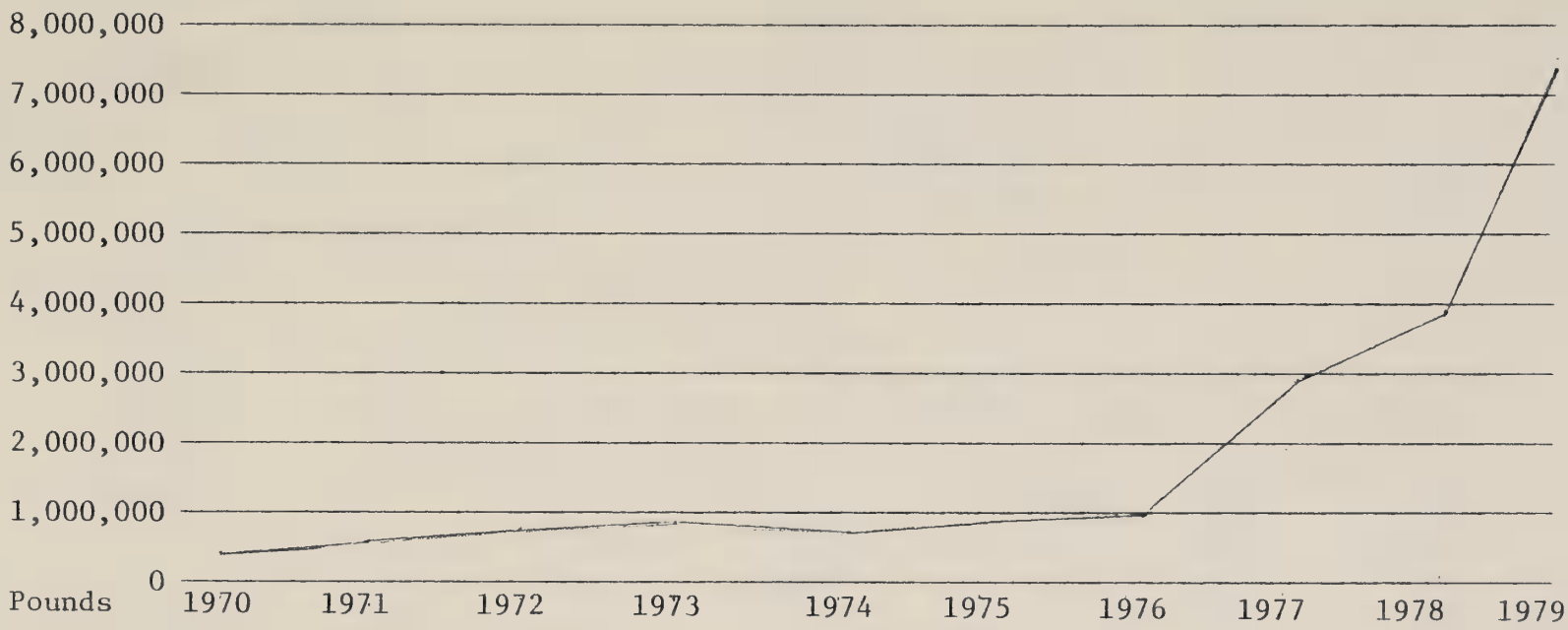


Figure 2. Total Yield of Sunflower (in pounds) in the U.S. from 1970 to 1979

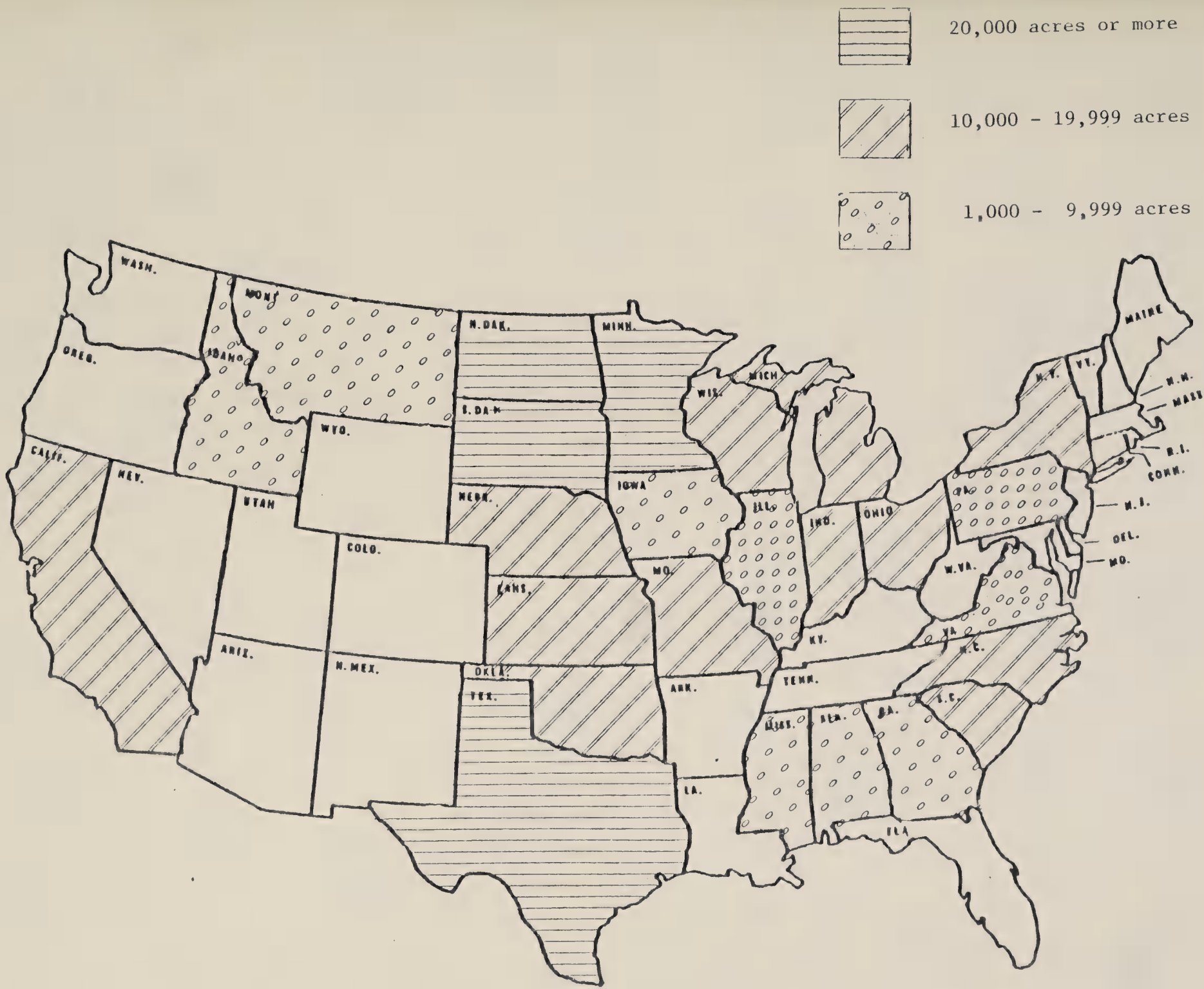
(Data taken from Reference 11.)

acre in 1970 to 1,362 pounds per acre in 1978. The average yield per acre declined slightly in 1979 from 1,362 pounds per acre to 1,350 pounds per acre. This could have been due to less favorable weather in 1979 or to the expansion of production acres into less productive areas. Sunflower is a relatively new crop in some of these expansion areas where production aspects are not well understood. Average yields would likely be higher if all growers followed better management practices (3). Greater cooperative extension service initiatives in these areas would pay worthwhile dividends.

Important Area of Production

Most sunflower production since the late 1950's has been in North Dakota, Minnesota, South Dakota, Texas, and California. Over 90 percent of the U.S. sunflower crop is grown in North Dakota, South Dakota, and Minnesota. North Dakota alone accounts for about 60 percent of the U.S. total crop. Other States in the upper Midwest are increasing production of sunflower. In these States sunflower production must compete with wheat and other small grain. However, sunflower makes a viable rotation crop for the small grains.

The sunflower is increasing in importance in the Southern States of Texas, Mississippi, Alabama, Georgia, and North and South Carolina, which have found it to be a viable alternative cash crop (Figure 3). The sunflower has filled some slack in cotton seed mills left with excess crushing capacity because of reduced cotton acreage. Attempts are being made on a relatively large scale to integrate the sunflower into double-cropping systems especially in the Southern States, and in the southern Corn Belt States.


20,000 acres or more
10,000 - 19,999 acres
1,000 - 9,999 acres
WASH.
OREG.
CALIF.
IDAHO
NEV.
MONT.
WYO.
UTAH
COLO.
ARIZ.
N. MEX.
N. DAK.
S. DAK.
NEBR.
KANS.
OKLA.
TEX.
MINN.
IOWA
MO.
ARK.
LA.
WIS.
MICH.
ILL.
IND.
OHIO
KY.
TENN.
MISS.
ALA.
GA.
FLA.
S.C.
N.C.
VA.
W.VA.
PA.
N.Y.
MAINE
VT.
N.H.
MASS.
R.I.
CONN.
N.J.
DEL.
MD.

The sunflower does relatively well under adverse weather conditions. Sunflower seedlings are more tolerant of frost than many crops, making it an attractive row crop for areas of the Great Plains where frost may occur during the seedling stage. Sunflowers compete well with soybeans in these areas because they have a shorter growing season and usually do better under drought conditions (3).

Sunflower Production, Price, and Value for the 1978-1979 Crop

The United States sunflower production, price and value for 1978 and 1979 as computed by the United States Department of Agriculture's Crop Reporting Board, is reported in Table 3. The United States season average price shown is computed by dividing value of sales by quantity sold.

Farmers received an average of 10.7 cents per pound for the 1978 oilseed sunflower crop. Based on the average annual yield of 1,362 pounds of seed per acre, sunflower growers grossed an average of $145.73 per acre from their sunflower crop. The average gross figure for corn for grain in 1978 was $213.53; for soybeans was $194.18; for grain sorghum $106.89, and for barley $91.96.

In a paper prepared by Dr. D. C. Zimmerman, SEA-AR, North Dakota, a crop profitability estimate reported for two counties in South Dakota (9) indicated that at the present prices and production levels, sunflower is quite competitive with other crops grown in South Dakota (Table 4).

Breakthroughs in the Sunflower

There have been two major breakthroughs in sunflowers in recent years: 1) the development in the mid-1960's of high oil sunflower varieties with an oil content of 40 percent, a one-third increase over previous varieties; and 2) the

Table 3. U.S. Sunflower Production, Price, and Value, 1978 and 1979 Crops*

Varietal Type	1978 Production	1978 Season Av. Price Per Cwt	1978 Value of Production	1979 Production	1979 Season Av. Price Per Cwt	1979 Value of Production
	1000 Pounds	Dollars	1000 Dollars	1000 Pounds	Dollars	1000 Dollars
Oil	3,538,140	10.70	379,576	7,008,550	8.69	609,236
Nonoil	314,400	10.80	33,948	297,040	12.10	36,020
Total	3,852,540	10.70	413,524	7,305,590	8.83	645,256

*These data are limited to reports from the States of Minnesota, North Dakota, South Dakota, and Texas.
(Data taken from Reference 6.)

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Table 4. Crop Profitability Estimate - 1980 a/

Crop	Price b/	Net return per hectare
Sunflower	$9.20	$245.13
Soybean	6.13	221.15
Flax	6.00	187.30
Barley	2.00	169.02
Wheat	3.80	165.31
Corn	2.23	147.77
Oats	1.40	112.43

a/Brookings and Lake Counties, South Dakota.

b/Estimates on February 27, 1980, by Art Sogn, South Dakota State University, Brookings, SD.

Table 4 taken from Reference 9.

development of the hybrid sunflower in the mid-1970's which boosted yields by 20 to 25 percent. In 1977, the year farmers made a major shift from open pollinated to hybrid sunflower varieties, hybrids were planted on over 90 percent of the planted area. In addition to higher yields, the hybrids have several other distinct advantages over open-pollinated varieties, including a much greater resistance to rust, more uniformity of flowering and maturing height, and seed oil content.

Oilseed sunflowers yield over 40 percent oil, whereas soybeans yield about 21 percent oil. On a per pound basis, the oil is worth more than the meal that results from processing. It is in the oil market where the sunflower stands to make its biggest gains in the future. Exports are currently the major market for oilseed sunflowers accounting for 70 to 80 percent of the United States crop. Domestic use of sunflower oil as food is expected to expand now that a dependable supply of U.S. sunflower oilseed is available for crushing purposes. Construction of the first "sunflower seed only" mill with a daily capacity of 1,250 tons was begun in the second half of 1979 at Riverside, North Dakota by Cargill Incorporated and is to be operational in 1980. A second sunflower seed processing plant is under construction at Velva, North Dakota. This plant is a joint venture by three companies, and will be operated by the Midwest Processing Company. It will have a capacity for processing 1,000 tons of sunflower seed daily. At least one processing plant is planned for the southern Corn Belt which will encourage more production in that region.

Product Properties

Sunflower oil compares favorably with other oils with which it must compete. It, therefore, has a promising future in the U.S. and the world. Some comparisons of sunflower oil with other types of oil produced on U.S. farms follow:

1. Sunflower oil is higher in polyunsaturates than corn oil and is much more stable than safflower oil. Thus it has an edge over these two competitors for use in premium grade margarine, cooking, and salad oils.

2. The higher price tag of sunflower oil currently limits it from making substantial in-roads against soybean oil in the vegetable shortening and lower price vegetable oil margarine markets.

3. Blended sunflower-soybean oil products are already on the market in some parts of the country and their use could grow in the years to come. Therefore, instead of being rivals, the two oilseeds could eventually end up complimentary in many of the world's fats and oils markets.

4. Another possibility is that the sunflower could become the major oil source in the United States while the soybean could become the major protein source in the United States.

5. A new use of sunflower oil that has not drawn much attention yet but may become more important in the future is the use of sunflower oil as a diesel fuel substitute. Sunflower can be grown in many parts of the country and produces more oil per acre than any other oil crop except the peanut. Continually increasing fuel cost and uncertainties in the Middle East suggest that it would be prudent to consider vegetable oils including sunflower oil as alternative fuels for on-farm and other uses. Accelerated research and extension initiatives should be considered in this area.

There are by-products of sunflower seed processing which should be considered in the expansion of the sunflower industry. One of these is sunflower meal which contains about 28 percent protein and 26 percent fiber. Sunflower meal can be used as a livestock feed particularly for ruminant animals according to reports from the North Dakota State University (9). Another by-product of sunflower seed processing is the sunflower hull obtained when the whole-seed is decorticated. The hulls are quite high in fiber and suitable as a roughage in certain animal feeds. Alternately, the hulls can be burned to provide heat or used in making fiberboard.

Markets

Now that the U.S. sunflower industry is gearing up for processing sunflower seed domestically, some analysts see an almost unlimited potential for sunflower as an oilseed crop (5). Among the factors in favor of the sunflower are: 1) profitability, 2) export demand, and 3) domestic demand. In 1979, the breakeven price for North Dakota growers, who produced over 60 percent of the U.S. crop, was about 8 cents per pound. Even though the average farm price for the current market in the 1979 season was the lowest since 1972-1973 at 9 cents per pound it still brought producers a good profit (6). As to export demand, Western Europe is by far the largest market for U.S. sunflower, taking nearly 90 percent of all U.S. sunflower seed exports. Currently the export market is the lifeblood of the sunflower industry. However, it is the domestic market that offers sunflower growers the greatest growth potential. Based on plant expansions and new mills announced, the U.S. crushing capacity is expected to rise from about one million metric tons in 1980 to 2.6 million tons by 1981/82 (7). In the

1979-1980 marketing year, domestic crushing of sunflower seed is expected to total 450,000 metric tons. U.S. consumption of sunflower oil is expected to jump from 78,000 to 120,000 tons and domestic use of the high protein sunflower meal will rise to 270,000 tons (7).

From the 1979 crop there was a sizeable domestic inventory. This inventory was caused by the record-breaking 1979 crop and by the 1979 dock strike by grain handlers in the Minnesota-North Dakota area. The strike impeded the movement of cargo from the tri-State area (North Dakota, South Dakota, Minnesota) into foreign markets. Because of this sizeable inventory the acreage planted in the United States in 1980 fell by about 20 percent to about 4.45 million acres. Prices also declined because of this inventory. In spite of this setback, the future of sunflower in the United States looks promising (9). As an indicator of the maturation of the sunflower industry in the U. S., a sunflower futures trading market began operating at the Minneapolis Grain Exchange on May 6, 1980. This should provide producers with some market alternatives and moderate the wide fluctuations in the sunflower seed prices that now occur.

The sunflower ranks seventh in export volume among crops in the United States with exports of 1.3 million metric tons in 1979. The sunflower also ranks eighth in export earnings with earnings of $0.4 billion.

Sunflower meal has the potential for expansion in the domestic livestock feed market. Unlike other oilseeds, sunflower seed contains no growth inhibiting or toxic elements. Toxic components in cottonseed, rapeseed, and soybeans must be deactivated in processing before a meal suitable for feeding can be produced (7).

Research and Extension Needs

As sunflower production expands into other States with different soils and climatic conditions, additional problems have caused some crop losses. Yield loss due to insect damage is probably the major impediment to expansion of sunflower acreage in many parts of the country (4). Scientists are currently conducting research on the sunflower in attempts to improve: 1) yield; 2) stand; 3) oil percentage; 4) protein content; 5) earliness of maturity; 6) strength of stalk; 7) disease and insect resistance, and pest control; 8) the use of the crop by-products--the hulls of the sunflower seed for cattle feed, fiberboard, fertilizers, and sources of energy, and 9) foreign and domestic market outlets to assure a continued demand.

Budgets for funding sunflower research experienced a substantial annual increase during the period from 1970 to 1978. However, the increases in funding did not parallel the dramatic increase in production for that period (Table 5, Figures 4 and 5). During the same time period the number of Federal and State research projects and the scientist years devoted to sunflower research also increased (13), but failed to keep up with the production increase (Figures 6 and 7).

Table 5. Number of Projects, Scientist Years, Federal and State Funds Devoted to Sunflower Research and Total Yield in Pounds From 1970 to 1978 Inclusive.

	No. of Projects	SYS	Total Funds	Total Yield in Pounds (000)
1978	92	14.9	$1,486,929	3,852,542
1976	88	12.6	1,046,963	857,100
1974	69	11.6	746,590	524,705
1972	46	10.2	525,580	633,560
1970	38	3.4	188,899	186,670

Data taken from Reference 13.

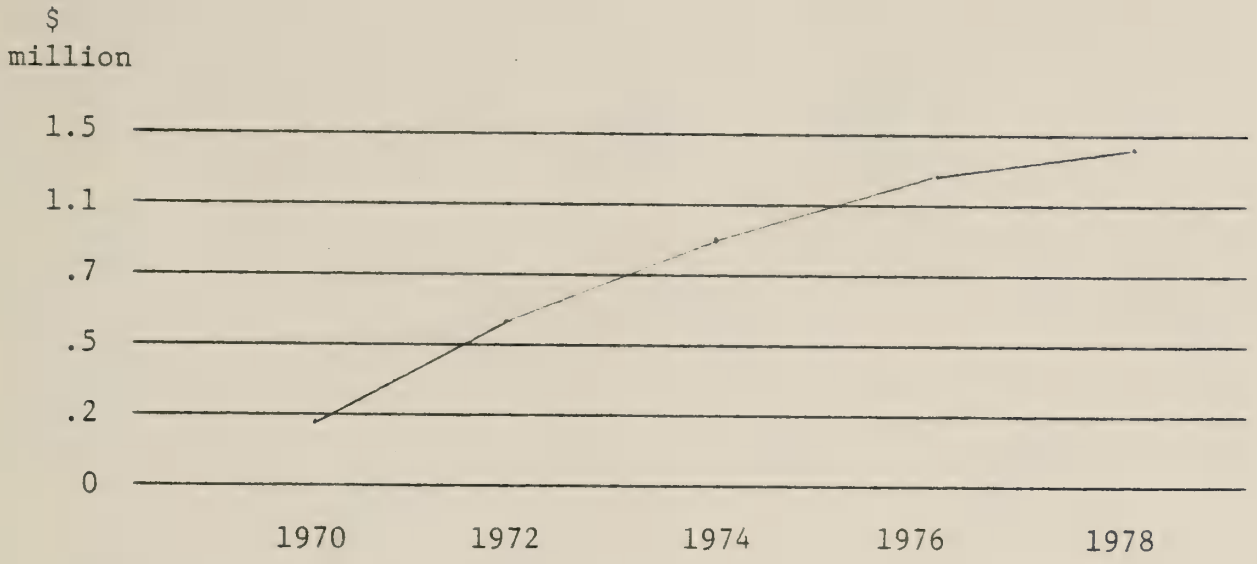

Figure 4. Federal and State Funds Expended for Research on Sunflower from 1970-1978 inclusive.
(Data taken from Reference 11.)

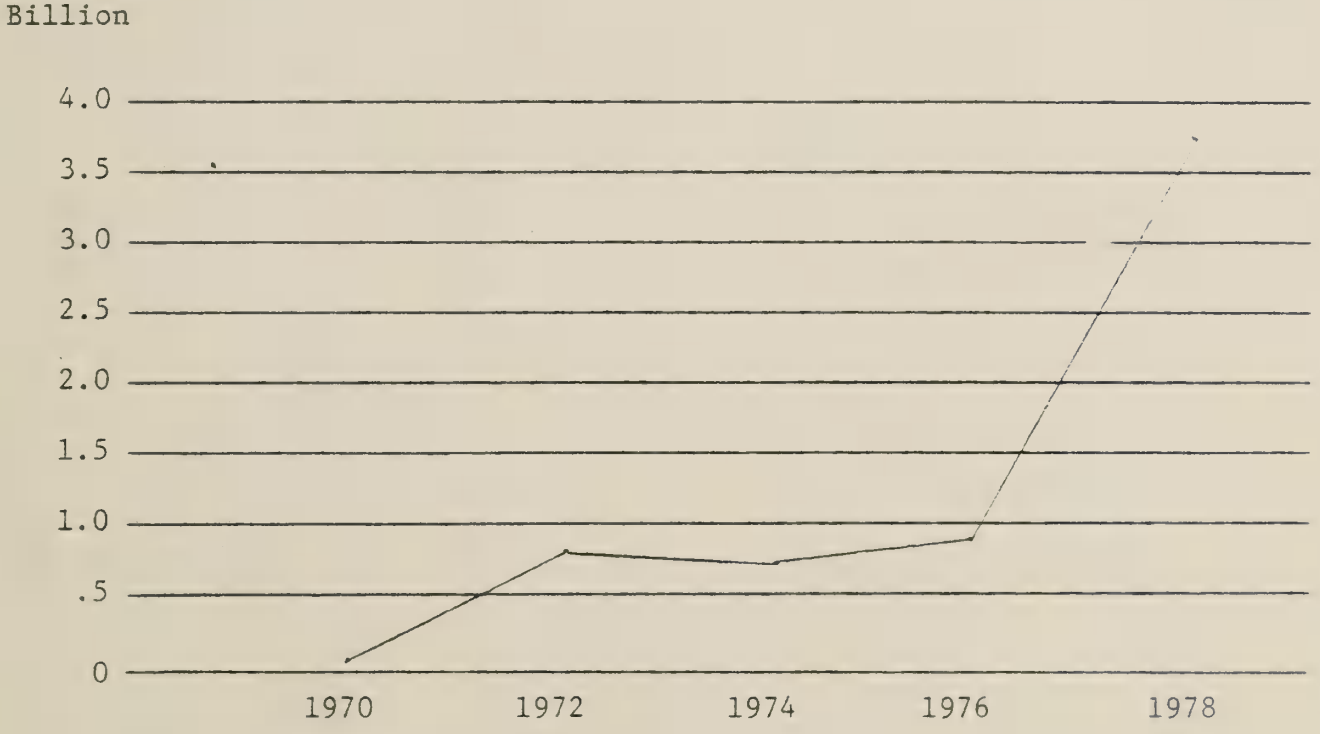

Figure 5. Total Yield in Pounds of Sunflower in the U.S. from 1970-1978 inclusive.

(Date taken from Reference 11.)

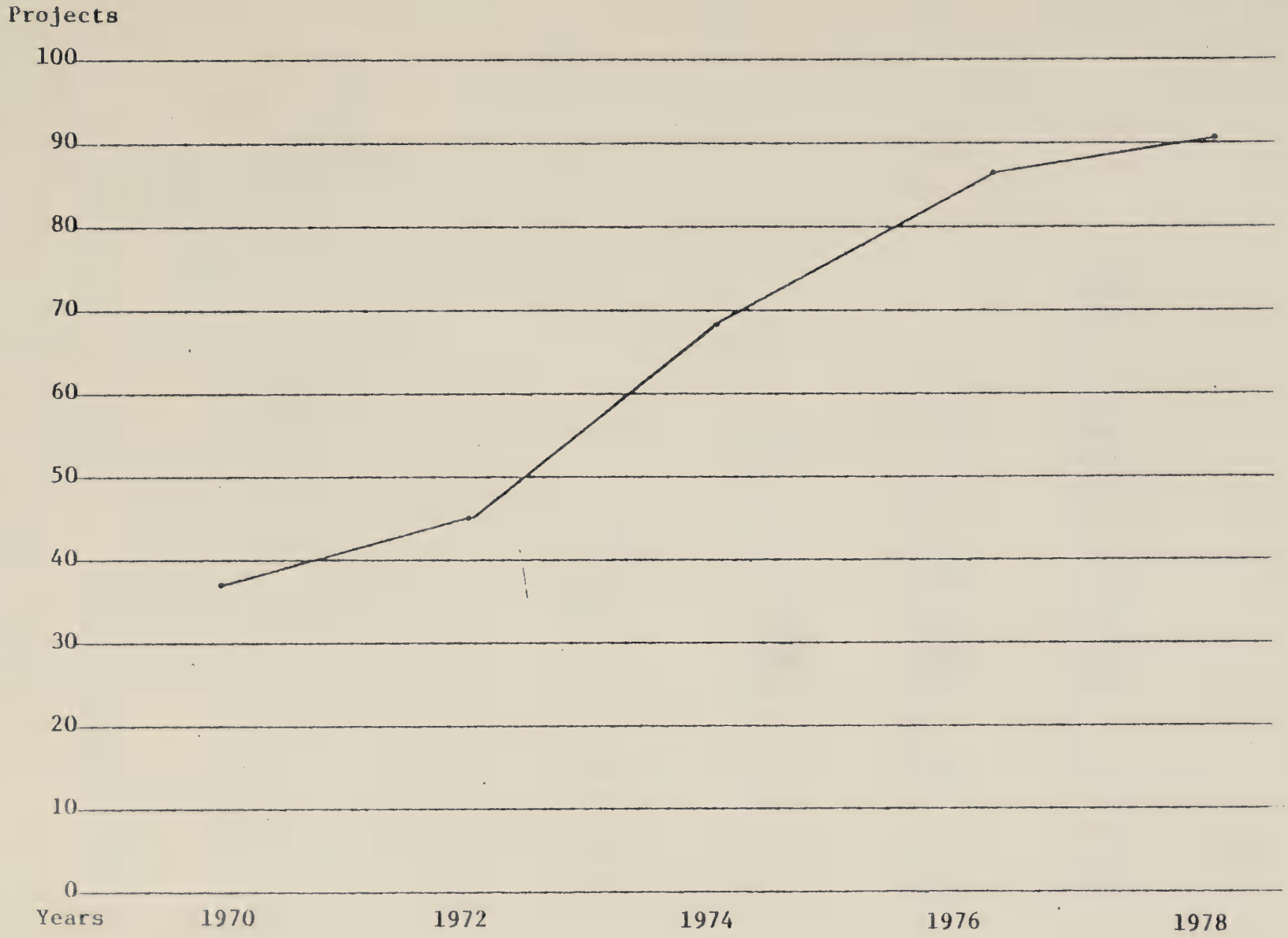

Figure 6. Number of Federal and State Funded Research Projects on Sunflower -- 1970-1978

Data taken from Reference 13.

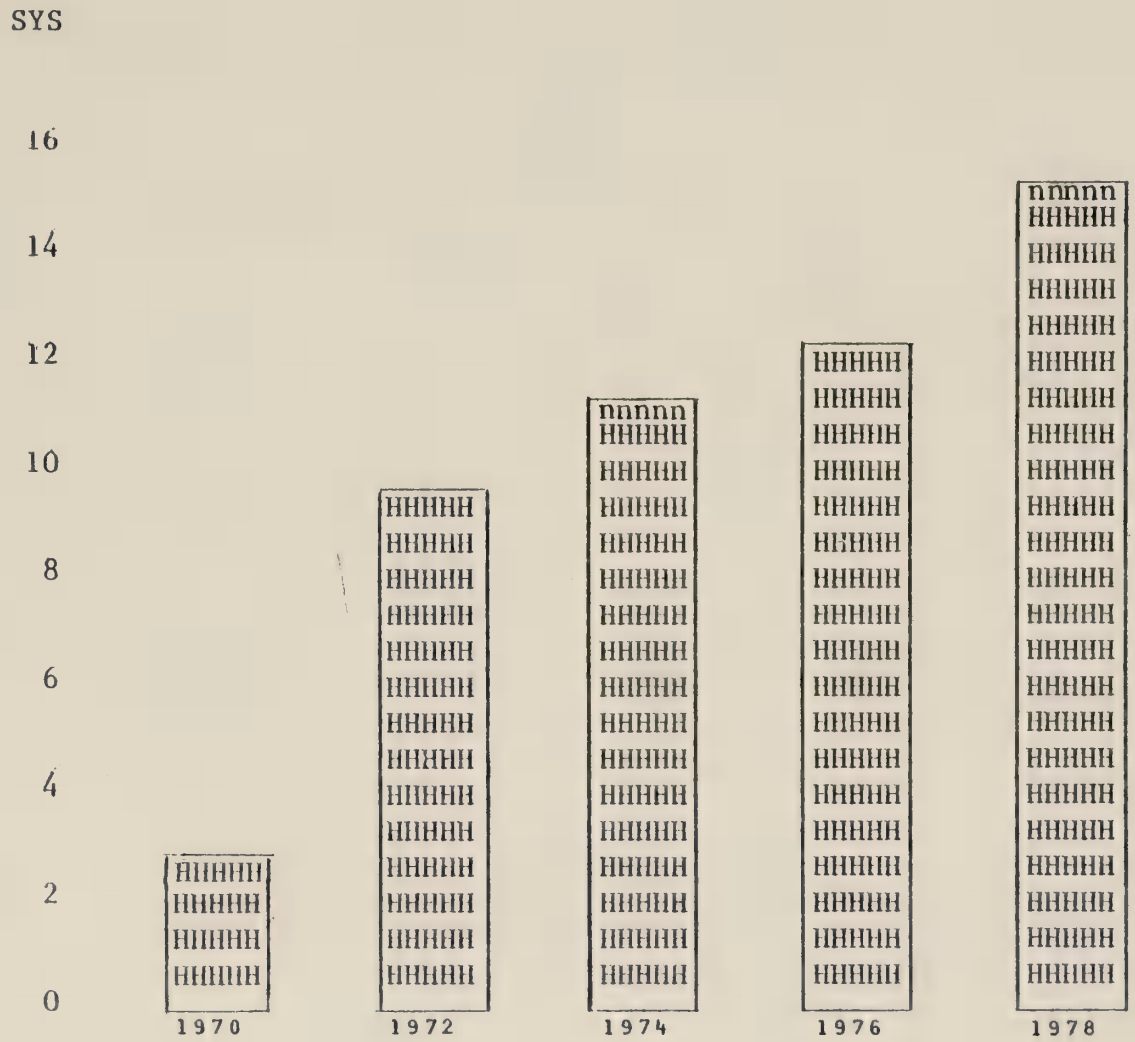

Figure 7. Federal and State Scientist Years Devoted to Sunflower Research -- 1970-1978

Data taken from Reference 13.

Also the export demand for sunflower oil, the growing demand of the domestic market and the resulting favorable price received for the product have encouraged many U.S. farmers to use sunflower as an alternative cash crop.

Not enough is known about the basic biology of many sunflower insects to allow the development of adequate control methods (9). The need for interspecific hybridization programs for improved insect and disease resistance are among the major production problems that research and extension should address.

Several industries in the private sector are doing some research and extension work on the sunflower. Most of this is in the area of applied research and market development. The basic research which brought about the development of inbred lines used to produce hybrid varieties of sunflower was largely the result of USDA research programs (3). The assimilation of the hybrid varieties from USDA produced inbred lines was done primarily by the private sector.

The private sector is also involved in research on the products of the sunflower. At least two approaches are currently being explored by engineers in the search for substituting sunflower oil for diesel fuel. One is to modify the fuel and the other is to modify the engines. In modifying the fuel different mixtures of diesel-sunflower oil are being tested (ex. 70% diesel-30% sunflower oil). The second approach is to modify engines to use 100 percent sunflower oil. Additionally the private sector is involved in research on sunflower-soybean oil blends as cooking oils; sunflower meal as protein supplements; sunflower hulls as fiberboard for the building industry; and sunflower hulls as a source of energy.

To continue to minimize the lag time between the discovery of new and improved varieties and the adoption by farmers, the Cooperative Extension Service should be adequately supported to carry out the necessary educational work. Cultural practices and insect and disease control will need intensive research and extension initiatives as the sunflower crop moves into new production areas.

Scientists indicate that the sunflower will not replace corn and soybean in the Cornbelt. However, on the periphery of the Cornbelt and in the Southern States sunflower is a viable alternative cash crop. It has the promise for fitting into double-cropping systems especially in the Southern States (12).

Conclusions

The sunflower has a promising future as a viable alternative cash crop and as such will likely increase in production and popularity in the 1980's because of the following reasons: 1) the growing demand for the polyunsaturated oil (70% polyunsaturated oil with 0 cholesterol content); 2) its high percentage oil content of the seed (40%); 3) its wide range of climate adaptation; 4) its ability to fit into double-cropping systems; 5) the nontoxic nature of the by-products that make them suitable for food and feed supplements without detoxification processes; 6) the uses and potential uses of the oil meal, and other by-products for protein supplements for human food and animal feed; 7) the potential use of the hull of the sunflower seed to be integrated into livestock feed, fiberboard, and fertilizer, and 8) the potential use of the oil as a substitute for diesel fuel.

Recommendations

In view of the favorable export market for the sunflower seed, and because of its potential as a viable alternative cash crop for many producers on the periphery of the Corn Belt, the Red River Valley of the Dakotas and Minnesota, and the southern Cotton Belt States and because of its growing popularity in the domestic market it is recommended that additional research efforts be devoted to:

1. The basic biology of major sunflower insects in the search for controls.

2. The development of sunflower germplasm with improved disease and insect resistance.

3. Increasing the percentage of oil in the sunflower seed.

4. Determining more efficient and more economical ways of using sunflower oil as a substitute for diesel fuel.

It is further recommended that additional research and extension initiatives be directed to the improvement of cultural practices in general, especially in the expanded production areas, through demonstration plots, and that research and extension efforts be devoted to market alternative programs for producers.

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